NLM PubMed/MEDLINE Advanced: Tips and Tools for Effective Searches

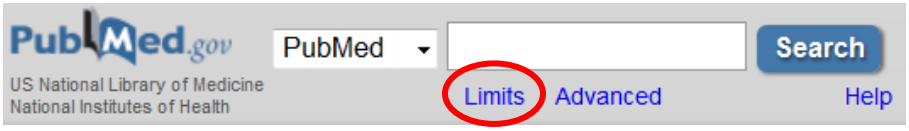
(Radiology focused)

National Library of Medicine
www.nlm.nih.gov

Additional PubMed Resources

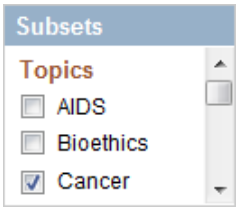
NLM brochures and handouts: http://nnlm.gov/gmr/training/handouts.html
NLM PubMed Online Training: http://www.nlm.nih.gov/bsd/disted/pubmed.html
NN/LM Non-English Guides to PubMed: http://nnlm.gov/training/resources/intlpubmedlinks.html

This project has been funded in whole or in part with Federal funds from the National Library of Medicine, National Institutes of Health, Department of Health and Human Services, under Contract No. HHS-N-276-2011-00005-C with the University of Illinois at Chicago. Revised November 2011.



Searching PubMed

Limits: PubMed has a number of options that simplify searching in specific disciplines.



- One option is to use **Subsets** under the **Limits;** for example, the ***Cancer*** subset was created by NLM and the National Cancer Institute (NCI) to aid in searching for citations to cancer-related articles.
- The cancer subset may also be used in a search as ***cancer [sb]***
- There is no radiological subset in Limits, but MEDLINE indexes more than 100 titles directly relevant to radiology.

Natural Language Searching

- Adding a specific radiological term increases the chances of getting appropriate citations (e.g. *breast cancer cat scan* or *lymph nodes MRI)*
- PubMed tries to match (or map) the term in the search box first with a **Medical Subject Heading (MeSH)** term, then as a **journal**, and then checks **author**; once a match is found, PubMed begins the citation search
- PubMed searches by the matched/mapped term(s) AND searches **All Fields** with the individual term(s)
- **NOTE:** PubMed may perform unexpectedly (see Example); review **Search details** after EVERY search

Using Boolean Operators – AND, **OR**, and **NOT**

- The default Boolean operator is AND
  - Boolean operators (AND, OR, and NOT) should be in upper case (e.g., *x-ray OR cat scan*)
  - PubMed processes the AND and OR Boolean operators in a left-to-right sequence
  - The NOT operator is processed first
- Nesting: PubMed creates nested arguments based on the information entered into the search box; changes to the PubMed-created order may be made in the Search details Query Translation box

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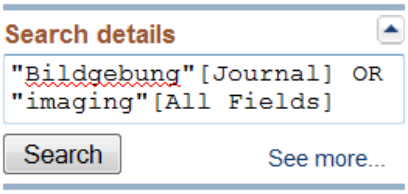
Example: How does PubMed map the term "imaging"? "Diffusion weighted imaging"?

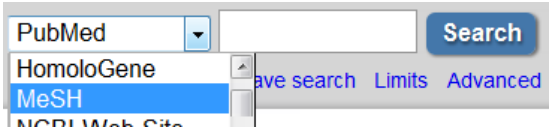


Search PubMed by entering ***imaging*** in the Search box.

- Because PubMed did not find a MeSH term for *imaging*, PubMed next searched for a journal and found a match (*Imaging* , a.k.a. *Bildgebung*); PubMed then ran a citation search for the journal and for imaging in **All Fields** (including author, address, etc.)
- A similar problem occurs with the term ***diffusion weighted imaging***; because the entire phase is not recognized by PubMed, PubMed breaks apart the phrase.

Click **See more** to make changes and corrections in the **Search details** Query Translation box and search the **MeSH database** to locate the term PubMed uses to find related citations.

MeSH – Medical Subject Headings

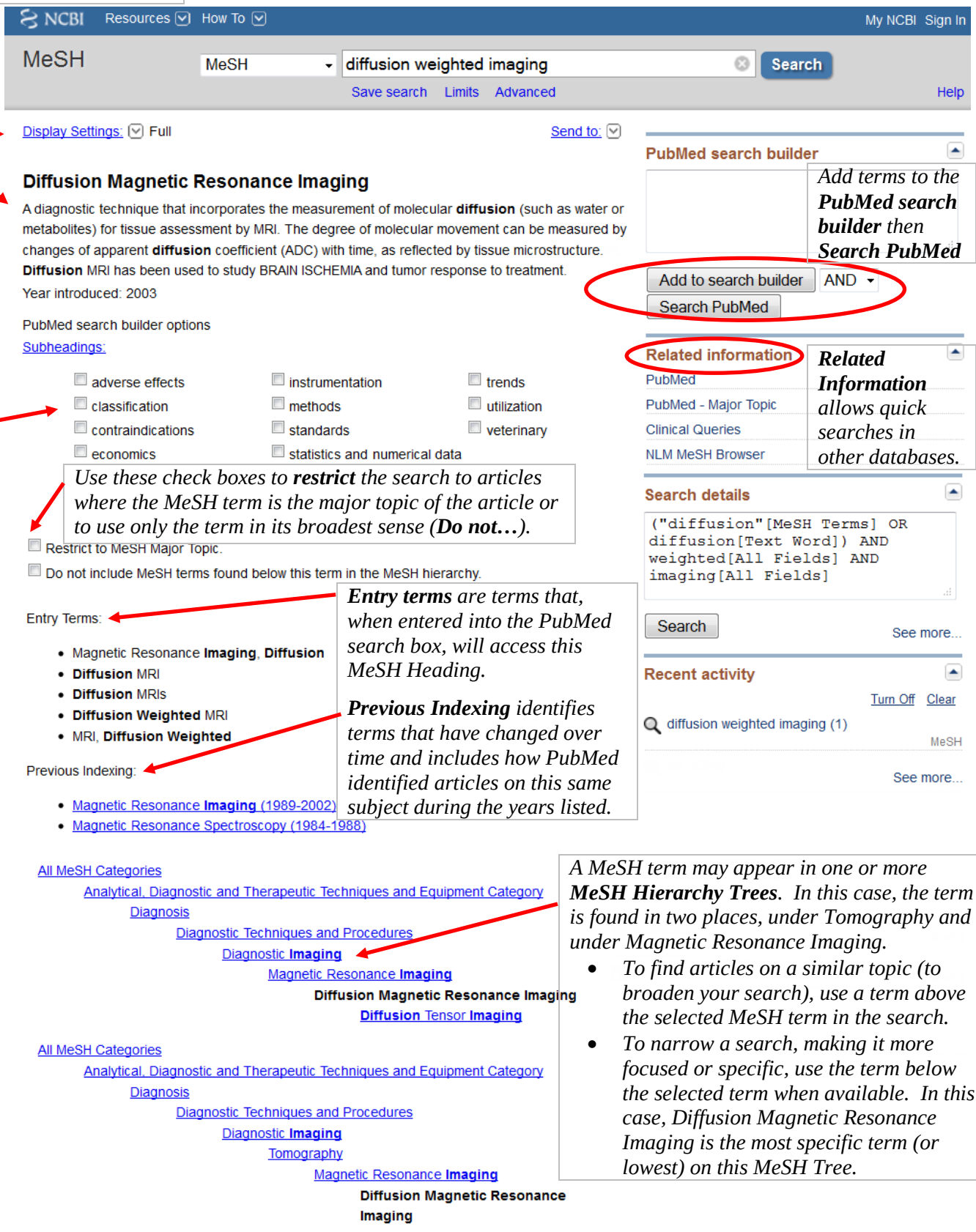


The Medical Subject Heading (MeSH) Database allows you to:

- Locate and select appropriate MeSH terms
- See the definition and other helpful information for a MeSH term
- Display MeSH terms in the hierarchy
- Attach subheadings for a search and/or limit MeSH terms to a major concept for a search
- Build a PubMed search strategy

The MeSH Term Description Screen

Display Full *shows all details on a term.*



Definition *or meaning of the term is described. Compare this to your expected definition.*

Add terms to the PubMed search builder *then* ***Search PubMed***

Related Information *allows quick searches in other databases.*

Subheadings *provide a specific focus for a search. Use the check boxes to select the subheadings. Click on the* ***Subheadings*** *link to see a list of subheading definitions.*

Use these check boxes to ***restrict*** *the search to articles where the MeSH term is the major topic of the article or to use only the term in its broadest sense (****Do not…****).*

Entry terms *are terms that, when entered into the PubMed search box, will access this MeSH Heading.*

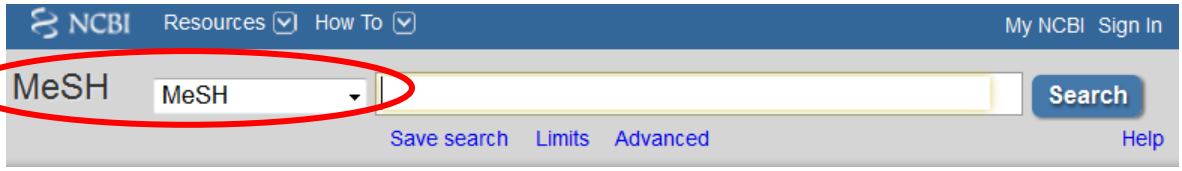
Previous Indexing *identifies terms that have changed over time and includes how PubMed identified articles on this same subject during the years listed.*

All MeSH Categories
Analytical, Diagnostic and Therapeutic Techniques and Equipment Category
Diagnosis
Diagnostic Techniques and Procedures
Diagnostic **Imaging**
Magnetic Resonance **Imaging**
Diffusion Magnetic Resonance Imaging
Diffusion Tensor **Imaging**

All MeSH Categories
Analytical, Diagnostic and Therapeutic Techniques and Equipment Category
Diagnosis
Diagnostic Techniques and Procedures
Diagnostic **Imaging**
Tomography
Magnetic Resonance **Imaging**
Diffusion Magnetic Resonance Imaging

A MeSH term may appear in one or more ***MeSH Hierarchy Trees****. In this case, the term is found in two places, under Tomography and under Magnetic Resonance Imaging.*

- *To find articles on a similar topic (to broaden your search), use a term above the selected MeSH term in the search.*
- *To narrow a search, making it more focused or specific, use the term below the selected term when available. In this case, Diffusion Magnetic Resonance Imaging is the most specific term (or lowest) on this MeSH Tree.*

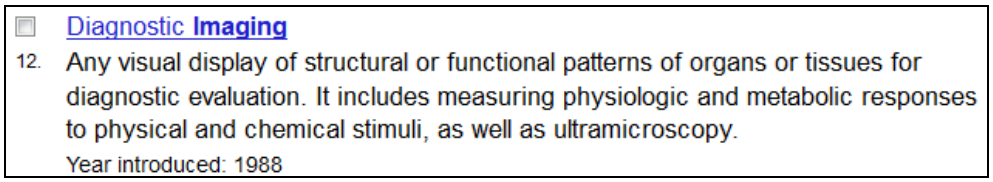


Access the MeSH Database in several ways

- From the drop-down menu in the search box, click **Search**
- From the ***MeSH Database*** link under **More Resources** on the PubMed homepage or in *Advanced*
- By accessing the *Abstract Supplemental Data*, (e.g. Publication Types, MeSH Terms, Substances) of a citation and clicking on a specific MeSH term

Find the Right Term

- A search in MeSH for ***imaging*** gives 543 results, the first of which is *Imaging, Three-Dimensional*; number 12 is ***Diagnostic Imaging***



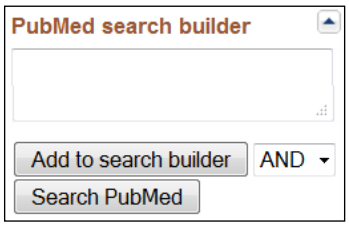
- Always read the definition
- Click on ***Diagnostic Imaging*** link to see the hierarchy tree
- Click on individual terms for more inform

All MeSH Categories
Analytical, Diagnostic and Therapeutic Techniques and Equipment Category
Diagnosis
Diagnostic Techniques and Procedures
Diagnostic Imaging
Cardiac-Gated Imaging Techniques
Cardiac-Gated Single-Photon Emission Computer-Assisted Tomography
Gated Blood-Pool Imaging
Image Interpretation, Computer-Assisted
Neuronavigation
Radiographic Image Interpretation, Computer-Assisted
Tomography, Emission-Computed +
Tomography, X-Ray Computed +
Imaging, Three-Dimensional
Echocardiography, Three-Dimensional +
Holography
Magnetic Resonance Imaging
Cholangiopancreatography, Magnetic Resonance
Diffusion Magnetic Resonance Imaging
Echo-Planar Imaging
Magnetic Resonance Angiography
Magnetic Resonance Imaging, Cine
Magnetic Resonance Imaging, Interventional
Microscopy

Example: Find MeSH terms for:

1. Mammogram
2. Gated Radionuclide Angiography
3. CCTA

- Once you find your terms, select any desired **Subheadings** and if they search is to be a **Major Topic** of the article, then click the **Add to search builder button**



- Add other terms if desired
- Click **Search PubMed**

Example answers:

1. Mammography
2. Gated Blood-Pool Imaging
3. Unfortunately, Cardiac computed tomographic angiography (CCTA) is not yet in MeSH. Use two terms: Coronary Angiography and Tomography, X-Ray Computed

Note: If a term is NOT in MeSH, try searching for the term in PubMed, locate an indexed (MEDLINE) citation using the term, then examine the *Abstract Supplemental Data* of the citation by clicking on the minus sign.

Publication Types, MeSH Terms

Searching Tips

Know Related Terms

- Once a Medical Subject Heading (MeSH) term is known, enter it directly into the PubMed search box without going through the MeSH Database

> **Example**: For ***chemoradiotherapy***, the PubMed Medical Subject Heading (MeSH) Term is *Combined Modality Therapy*.

The *All Fields* or Keyword Search

- **[All Fields]** refers to the fact that every field in PubMed will be searched for the term in question – including author, title, abstract, address, grantor, substance name, journal, dates, MeSH term, etc.
- PubMed breaks apart search terms to retrieve the maximum number of possible results – which may be more than desired
- Use **Search details** to eliminate unwanted terms

> **Example**: A search for ***cat scan*** also includes a search for ***("cat"[All Fields] AND "scans"[All Fields])*** – scans of kitty cats

- Use the keyword search for terms that are not in the MeSH database (especially terms new to the field)
- Add [TIAB] to a search to restrict the search to terms found in the title or abstract of an citation
- Add MEDLINE[sb] to restrict a search to only those citations that have been indexed (are part of MEDLINE) in order to look for potential MeSH terms

> **Example**: Search for CCTA in the title or abstract of an indexed citation ***CCTA[tiab] AND medline[sb]***

Subheadings [sh]

- The most precise way to search in most disciplines is to use MeSH subheadings, also known as qualifiers
- For radiological applications, the subheadings/qualifiers are useful ways to limit the retrieval set to specific radiological applications; using subheadings provides searchers with a specific focus to their search
- Five subheadings related to radiology – and their two letter codes – are:

Radiation Effects	RE	Radiotherapy	RT
Radiography	RA	Ultrasonography	US
Radionuclide Imaging	RI		

- Attach subheadings directly to MeSH terms using the format: *MeSH heading/subheading*; use either the two letter abbreviations for subheadings or the full subheading name

> **Example:** The identical search on radiotherapy of brain cancers can be made by using *brain cancer/rt*, *brain cancer/RT* or *brain cancer/radiotherapy*.

- Only one subheading may be attached to a MeSH heading at a time; to attach multiple subheadings, combine each MeSH heading/subheading combination with the OR connector

> **Example:** Search for either ultrasonography or radionuclide imaging on the spine.
> Use: *spine/ultrasonography OR spine/radionuclide imaging*
> This is an identical search: *spine/us OR spine/ri*

- Case and spacing do not matter

> **Example:** *radiography[sh] = radiography [sh] = RADIOGRAPHY[SH]*

Free-floating subheadings [sh]

- You may also choose to "free-float" a subheading with a MeSH heading using the Boolean AND and the subheading field tag of [sh]
- This strategy searches for radiography attached to **any** MeSH term, whether heart, dementia or another indexed term; capitalize the Boolean operators when using subheading tags

> **Example:** Find radiology studies on heart patients with dementia.
> *heart AND dementia AND radiography [sh]*

Additional MeSH Tags

PubMed seeks to find the most related terms by ***exploding*** MeSH Terms. When a MeSH heading is identified, **every** term under that heading in the hierarchy tree is also retrieved. For example, searching ***Magnetic Resonance Imaging***, retrieves articles not only on MRIs, but also those articles focusing solely on *Diffusion Magnetic Resonance Imaging* or on *Echo-Planar Imaging.*

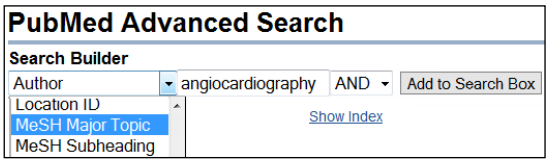
- Use the *Do Not Explode* tag **[mh:noexp]** to restrict searches to articles focusing on the broader concept

> **Example:** Find general articles on radionuclide imaging.
> *Radionuclide Imaging [mh:noexp]*

- **[Majr]** is the tag for ***Major Topics*** which restricts a search to citations where the selected term is the major topic or a main focus of the article. Note: [majr] = [MAJR] = [Majr]
- *Major Topics* may be used in combination with the *Do Not Explode* command: **[majr:noexp]**

Tips Summary

- Use **Search details** to add to, subtract from and adjust a search
- Use **Search History** in *Advanced Search* to combine searches previously saved in My NCBI with new information and/or searches
- Use the **Search Builder** in the **Advanced** to identify MeSH terms and build PubMed searches
  - Use the drop down menu to select a field to search
  - Use the **Show Index** feature to reveal the number of citations used by that term



- Use the **MeSH Database** to identify correct and appropriate search terms
- Use **MeSH Subheadings** and **Field Tags** to focus a search; Note: Tags should always follow the term, indicating the field to be searched

Incorrect entry:	*[sh] radiotherapy*
Correct entry:	*radiotherapy [sh]*

- Use **PubMed My NCBI** to save search strategies that may be used as part of future searches – and to save collections of citations.
- Use the **NLM Catalog** to build a search based on specific journals (i.e. radiology-oriented) , then run the search in PubMed and save it in My NCBI
- Use the online ***PubMed Help*** manual or the ***Advanced PubMed Searching Resource Packet*** for more information on the shorthand codes and a complete list of the possible search tags.
  - PubMed Help: http://www.ncbi.nlm.nih.gov/bookshelf/br.fcgi?book=helppubmed
  - Advanced PubMed Searching Resource Packet: http://nnlm.gov/training/resources/pubmedpacket.doc

Use **My NCBI Customized** services

- **Saved Searches:** Includes the option to have PubMed send email updates of the latest citations
- **Collections:** Save individual citations to new or existing collections; share collections with others
- **My Bibliograpy:** Citations by a singe author
- **Recent Activity:** Search strategies and viewed items are stored for six months
- **Filters:** Available from the search results page

Set **NCBI Site Preferences**

- **E-mail Address:** Update one email address
- **Linked Account:** With other organizations
- **Highlighting**: For search terms
- **Abstract Supplemental Data:** Set **Open** to view MeSH headings while in Abstract view
- **Auto Suggest:** May be tured off
- **Result Display Settings**: Set how the search Results page will appear when signed in

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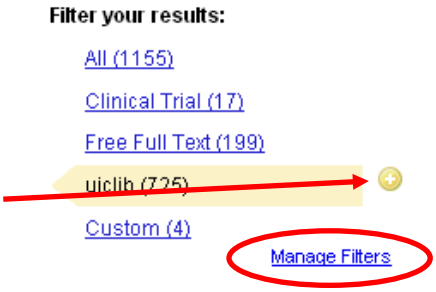
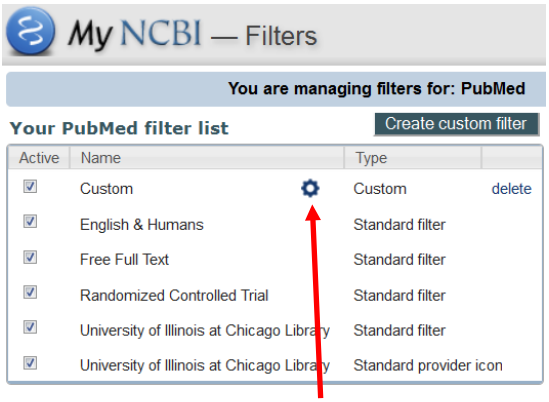
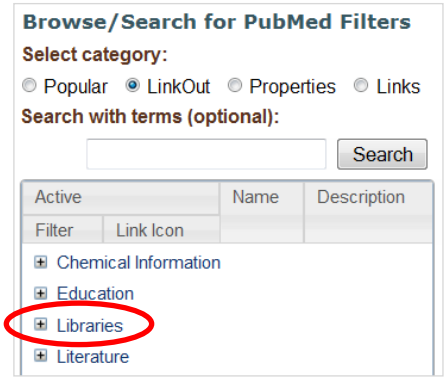
Manage Filters



Filters groups search results by areas of interest. Access filters from ***Manage Filters*** either from the search **Results** page or in My NCBI

- Filters may be added to a PubMed search by first clicking on the filter link, then using the ***Plus*** sign; exception, Custom filters do not have plus signs
- A maximum of **fifteen** active filters may be set using My NCBI
- An infinite number of provider icons may be seletect; these appear in the Abstract disply fomat
- The **filter list** includes all currently active filters





- **Popular** identifies nine common filter options
- **LinkOut** provides filters from outside sources
- **Properties** includes filters related to Limits
- **Links** accesses citations with links to other NCBI databases
- **Custom Filters** permits the creation of a filter based on the search of your choice; however, a custom cannot be added to a search as other filters can

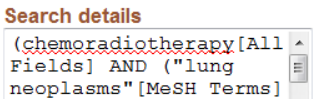
Add a Filter for a Specific Library

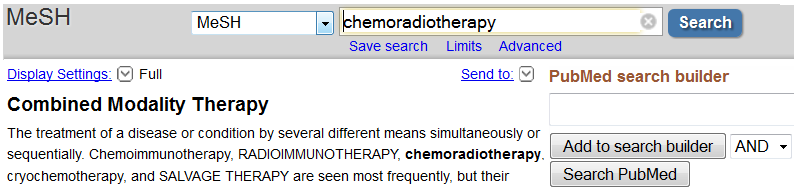
- First, verify there are less than fifteen active filters. If not, deselect a filter by unchecking the box of a filter no longer needed, the new library filter will become the fifteenth filter
- Under **Browse/Search for PubMed Filters**, click the **LinkOut**; button then search for all or part of the library name. Alternatively, click **Libraries** and then on the first letter of the library's organiztional name
- Check the box **Filter** and, optionally **Link Icon.** The filter will appear in the filter list and the Results page after every search

Exercises

Exercise 1: Find articles clinical trials of chemoradiotherapy on female lung cancer patients.

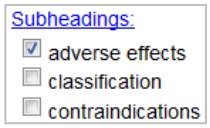
- Enter **chemoradiotherapy** and **lung cancer** in any order in the PubMed search box, then click on **Limits**; check the boxes for **Type of Article – Clinical Trial** and **Gender – Female**. Click **Search.** (~220 citations.)
- Scroll down to **Search details.** Note that *lung cancer* mapped to MeSH term *lung neoplasms* is a MeSH term, but *chemoradiotherapy* was treated as a keyword **[all fields].** Not all related articles were found.



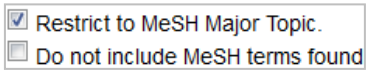


- Use the drop-down menu to access the MeSH database and search for *chemoradiothearpy*. **Add to search builder** the retrieved term *combined modality therapy*, then **Search PubMed.**
- Add "AND lung cancer" to the search to retrieve over 1750 citations with the previously set limits.

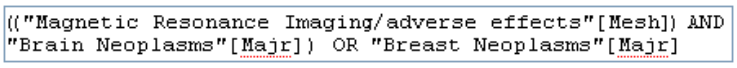
Exercise 2. Use the MeSH Database to identify articles discussing the adverse effects of MRIs in cancer patients. Limit these to articles focusing either on brain or breast cancer patients.



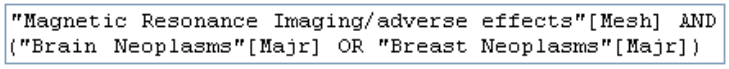
- In the MeSH database, search for ***MRI***; click the correct MeSH term. Under *Subheadings*, select the box for ***adverse events***, then use the ***Add to Search builder AND*** button
- Still in MeSH, search for ***brain cancer*** and select the correct term. Check ***Restrict to MeSH Major Topic*** and again use ***Add to Search builder AND***



- Find the MeSH term for ***breast cancer***, again select ***Restrict to MeSH Major Topic***, but this time use ***Add to Search builder OR***



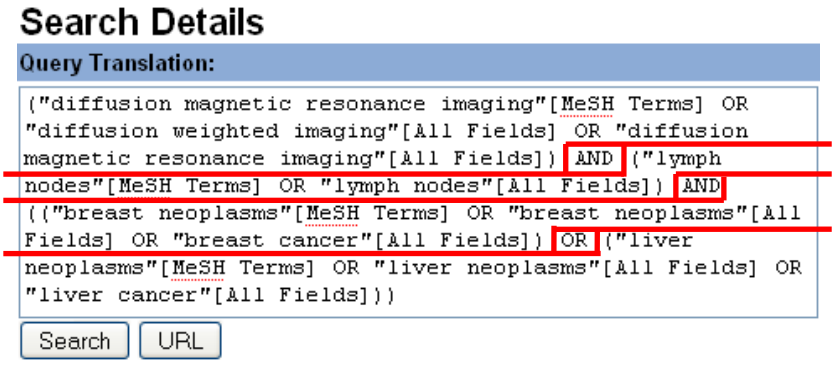
- In the search box, adjust PubMed's default parentheses to reflect the correct search strategy



- Click the ***Search PubMed*** button for ~5 results

Exercise 3: Find articles discussing diffusion weighted imaging on the lymph nodes of patients with breast or liver cancer.

- Identify the correct term for *diffusion weighted imaging* in the MeSH database and use the search builder to send the term to PubMed
- In PubMed, add the remaining search terms with the Boolean terms capitalized, include parentheses: AND lymph nodes AND (breast cancer OR liver cancer)
- Click ***Search***
- Go into ***Search details*** by clicking **See more;** adjust the search to accurately reflect the search question by changing misplaced parentheses and deleting any unneeded terms



- Click the ***Search*** button to identify about 16 citations

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Exercise 4: Add a filter to identify articles available through your library or library system. Follow the steps listed on page 7.